TECOM PROJECT NO. 8-ES-505-QRP-002
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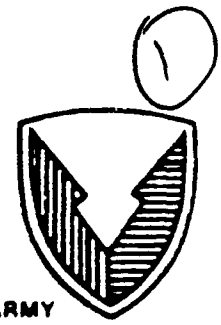

TEST PLAN SUMMARY

TECHNICAL FEASIBILITY TEST

OF THE

QUICK RESPONSE MULTICOLOR PRINTER SYSTEM (QRMP-S)

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U.S. ARMY COMBAT SYSTEMS TEST ACTIVITY
ABERDEEN PROVING GROUND, MD 21005-5059

NOVEMBER 1992

Prepared for:
U.S. ARMY TOPOGRAPHIC ENGINEERING
CENTER
FORT BELVOIR, VA 22060-5546

U.S. ARMY TEST AND EVALUATION COMMAND
ABERDEEN PROVING GROUND, MD 21005-5055

TEST PLAN SUMMARY

1. TITLE. Technical Feasibility Test of the Quick Response Multicolor Printer System (QRMP-S), TECOM Project No. 8-ES-505-QRP-002.

2. REFERENCES.

A list of references is provided in Appendix A.

3. BACKGROUND.

The need exists for a quick turnaround, low volume, multicolor printer to output topographic and terrain products to support special operations and decision making, planning and combat operations on the modern, fast-paced battlefield. U.S. Army Topographic Engineering Center (TEC) is fulfilling this need through the integration, with slight modifications, of Commercial, Off-the-Shelf (COTS) printing, reproduction, scanning, and processing hardware and software. Modifications to this hardware will include those needed for the equipment to survive the additional stresses placed on military equipment. This system is not intended to meet all QRMP Required Operational Capability (ROC) requirements, but to develop an interim reproduction system to fulfill some of these requirements until technologies mature.

To support this effort, TECOM authorized the U.S. Army Combat Systems Test Activity (CSTA) to plan and conduct testing of the QRMP-S shelter and prime mover to provide the data needed to establish what modifications are needed to the QRMP hardware (app A, ref 1).

4. TEST OBJECTIVE.

The objective of this test is to measure and record shock and vibration data the QRMP-S components can expect to encounter during operational use and transport.

5. SCOPE.

One QRMP-S shelter with prime mover (M942 5-ton truck with customized air-ride suspension) will be provided to CSTA with dummy mass loads installed in the shelter in place of the actual QRMP-S components. The test item will be instrumented with triaxial accelerometers in order to gather shock and vibration data. Testing will include a road shock and vibration course, transit drop, and rail impact.

6. INDIVIDUAL SUBTESTS.

6.1 Initial Inspection

6.1.1 Objectives.

The objectives are:

a. To determine that the test item is in good and safe condition, and to correct any defects or shipping damages noted before testing.

b. To record major component serial numbers and other pretest data.

6.1.2 Criterion.

The Quick Response Multicolor Printer System (QRMP-S) must be in serviceable condition as determined by the Preventive Maintenance Checks and Services (PMCS) section of the Operator's, Unit, Direct Support, and General Support Maintenance Manual (Test Agency devised).

6.1.3 Test Procedure.

This procedure is taken in general from Test Operation Procedure TOP 2-2-505 (para 2e).

Limited visual and functional inspections will be accomplished on the M942 5-ton truck and the QRMP-S shelter to ensure no damage was incurred during shipment and that the system is in satisfactory condition for testing. Components and assemblies will not be disassembled for inspection. Major component serial numbers will be recorded for the item.

The test item will be subjected to a specific inspection for safety to ensure personnel safety during operation and maintenance.

The following data are required:

a. Major component serial numbers.

b. Defects or damage noted.

c. Record of components not operating properly.

d. Record of adjustments made.

e. Safety problems noted.

f. Compliance or noncompliance with test criterion.

g. List of items received in the system support package (SSP) and the basic issue items (BII).

h. Interference or problems noted concerning BII.

Efforts to determine compliance to the test criterion (para 6.1.2) will be limited to visual inspections or functional checks using procedures given in the technical manuals supplied with the system. Partial disassembly or tear down of components to verify criterion requirements will not be done.

The SSP and BII will be inventoried. The BII will be installed on the truck for use during the test as necessary.

General view photographs of the system will be taken.

6.1.4 Analytical Procedure.

The visual and functional checks and the initial service will be used to establish a baseline for the test item. Defects or problems noted that would seriously limit the operational capability of the system will be corrected. All defects or problems noted will be recorded.

The criterion in paragraph 6.1.2 will be addressed for compliance or noncompliance based on the results of the initial inspection. Details will be included in the final report.

Defects or problems found including noncompliance with the criterion will be covered in detail in Test Incident Reports (TIRs) and in the final report. Analysis will include possible corrective actions, as applicable.

6.2 Road Shock and Vibration

6.2.1 Objective. The objective is to measure the levels of shock and vibration imparted to QRMP-S components through the mounting facilities of the QRMP-S shelter during road transport.

6.2.2 Criterion.

None.

6.2.3 Test Procedure.

a. The QRMP-S, mounted on the M942 5-ton truck with customized air-ride suspension, will be driven in a loop around the Munson Test Course at Aberdeen Proving Ground, Maryland five times. This loop shall consist of the following road courses and at the speeds indicated in Table 6.2-1. Data will be recorded continuously on each course at the test speed for the initial and final laps around the test course.

TABLE 6.2-1. ROAD SHOCK AND VIBRATION TEST COURSE SCHEDULE

Test Course	Vehicle Speed mph	kph
6-Inch Coarse Washboard	5	8
Belgian Block	20	32
2-Inch Washboard	10	16
Radial Washboard	15	24
3-Inch Spaced Bump	20	32

b. Data verification will be performed as the testing is conducted to ensure that the data are as accurate as possible. The data will be checked for frame errors, wild points, and DC shifts. In addition, amplitude distribution data will be compiled to aid in the verification process. Data verification procedures will be explained in detail in the final test report.

c. Instrumentation. Each dummy mass load (representing a QRMP-S element) designated by the materiel developer will be instrumented with three piezoresistive accelerometers to measure acceleration in the orthogonal axes (vertical, lateral, and longitudinal). These instruments will be installed as close to the base of each item as space permits to measure the base input of the forcing function.

(1) An on-board pulse code modulation (PCM) data acquisition system will be used to acquire the acceleration data while the M942 truck traverses the test courses. All data channels will be digitized sequentially at a rate which will allow a frequency resolution of approximately 1.0 Hz to be obtained. All channels will be low-pass filtered at 500 Hz. A detailed description of the data acquisition system will be provided in the final test report.

(2) Prior to testing, an electrical calibration shall be performed on all channels. Prior to each daily operation, a linear least-squares curve-fit will be performed on the calibration data to determine system linearity and to provide a quality check on the calibration data.

6.2.4 Analytical Procedure. The vibration data derived from this test will be presented in tabular and graphical formats, including plots of frequency distributions and power spectral densities. Additionally, a statistical analysis will be performed on this data.

6.3 Transit Drop

6.3.1 Objective. The objective is to measure the levels of shock and vibration imparted to QRMP-S components through the mounting facilities of the QRMP-S shelter during loading and unloading of the QRMP-S shelter onto or off of its prime mover.

6.3.2 Criterion.

None.

6.3.3 Test Procedure.

The QRMP-S shelter will be removed from the M942 5-ton truck and placed on a hard, level, concrete floor. One end of the shelter will be supported on a sill 13 to 15 cm (5 to 6 in.) in height. The opposite end will be raised to a height of 30 cm (12 in.) and allowed to fall freely to the concrete floor. This test will be applied to each bottom edge of the shelter. Once the shelter has been dropped onto each bottom edge, it will be raised to a height of 30 cm (12 in.), with the bottom face parallel to the concrete floor, and dropped flat onto the bottom face, for a total of five drops.

Instrumentation for this test will be the same as for the road shock and vibration test (para 6.2.3).

6.3.4 Analytical Procedure. The vibration data derived from this test will be presented in tabular and graphical formats, including plots of frequency distributions and power spectral densities, as well as G-forces encountered as a function of time. Additionally, a statistical analysis will be performed on this data.

6.4 Rail Transportability

6.4.1 Objective. The objective is to measure the levels of shock and vibration imparted to QRMP-S components through the mounting facilities of the QRMP-S shelter during rail transport.

6.4.2 Criterion.

None.

6.4.3 Test Procedure.

a. General. The QRMP-S, mounted on its prime mover, will be subjected to the Association of American Railroads Rail Impact Test. The configurations of the restraint system used during this test will be provided by the test sponsor.

b. Test Conduct. The basic procedures of MIL-STD-810E, Method 516.4, Procedure VIII, will be used as guidance for this test. Exceptions to the care of the restraint system during the test are noted in the following procedures.

(1) The test item will be mounted on a wooden decked, 50-ton, USAX flatcar (the test car); the M942 5-ton truck with QRMP-S shelter mounted being in direct contact with the test car deck. The test car will be impacted into an upweighted railcar (buffer car) with a total weight of 112,900 kg (248,900 lb). The air and hand brakes of this stationary, buffer car will be set for this test, while the slack will be removed from its coupler which faces the test car.

(2) The device used in the determination of the impact speed will consist of an electronic timer which is started and stopped by a pair of microswitches actuated by contact with the leading wheels of the railcar containing the test item. The microswitches will be spaced 1.5 meters (5 ft) apart, with the stop switch located within 2.1 meters (7 ft) from the point of impact. The impact speed will be calculated based on the time required for the test car to traverse the distance between the microswitches.

(3) The test car will be impacted into the stationary buffer car. A total of four impacts will be accomplished; at speeds of 6, 10, and 13 km/hr (4, 6, and 8 mph) with the forward end of the M942 truck facing the buffer car, and the final impact at 13 km/hr in the reverse direction.

(4) Since this is a shock test rather than an attempt at rail transportability certification, adjustment or repair of the restraint system used for the test item will be allowed between impacts. Additionally, the installation of dummy mass loads in place of actual QRMP-S components in the shelter precludes using this test to certify the system for rail transportability with Military Transportation Management Command, Transportation Engineering Agency (MTMC-TEA).

c. Inspections. The test item, as well as the blocking and tie-downs used during this subtest, will be examined before and after each impact. The general condition of the dummy mass loads and their mounting provisions will be noted through visual inspections conducted before the test and after each impact.

d. Instrumentation. The QRMP-S will be instrumented in the same manner as previous subtests (para 6.2.3 and 6.3.3).

e. The following data are required:

(1) Descriptions and illustrations of the configuration of the tie-downs employed.

(2) Location and orientation of the test item on the railcar.

(3) Number of impacts.

(4) Speed of test car just prior to each impact.

(5) Direction of each impact.

(6) Listing of any damage to the test item, the blocking, bracing, and cabling which constitute the tie-down.

(7) Vibration data as provided by the instrumentation.

6.4.4 Analytical Procedure. The vibration data derived from this test will be presented in tabular and graphical formats, including plots of frequency distributions and power spectral densities, as well as G-forces encountered as a function of time. Additionally, a statistical analysis will be performed on this data.

7. SUPPORT REQUIREMENTS.

a. CSTA.

(1) Shock/vibration and automotive test facilities.

(2) Instrumentation and data acquisition systems for measurement of shock/vibration during all testing.

(3) Personnel to operate the M942 5-ton truck during road shock and vibration testing.

(4) Database storage of all test data in an automated system.

(5) Engineering and other technical personnel to conduct specific subtests.

b. Program Manager - Combat Terrain Information Systems.

(1) One QRMP-S shelter with dummy mass loads installed and one M942 5-ton truck with customized air-ride suspension.

(2) Training for CSTA operators in the operation of the central tire inflation system in the M942 truck.

(3) Technical manuals for the operation of the M942 truck.

(4) List of desired locations on the QRMP-S for installation of accelerometers.

8. TEST SCHEDULE.

The test sequence exhibited in Appendix B will be adhered to as long as circumstances permit. The availability of the test item, occurrence of certain test incidents or other unforeseen factors may compel deviation from this agenda; however, continued operations will be conducted in a technically sound and programmatically efficient fashion.

9. COORDINATION.

Informal coordination will be accomplished by distribution of this test plan summary to the following agency:

Project Manager
Combat Terrain Information Systems
ATTN: CETEC-TL-RD (Mr. Hollandsworth)
Fort Belvoir, VA 22060-5546

APPENDIX A. REFERENCES

1. Memorandum, TECOM, AMSTE-TA-S, 8 September 1992, subject: Test Execution Directive for Technical Feasibility Test (TFT) of the Quick Response Multicolor Printer (QRMP), TECOM Project No. 8-ES-505-QRP-002.

2. Memorandum, U.S. Army Topographic Agency, CETEC-TL-RD, 26 August 1992, subject: Request for Customer Tests or Test Support from TECOM.

3. AMC Regulation 70-13, Test and Evaluation, Incidents Disclosed During Materiel Testing, 16 August 1982.

4. MIL-STD-810E, Environmental Test Methods and Engineering Guidelines, 14 July 1989.

5. TOP 2-2-505, Initial Inspection and Preliminary Operation of Vehicles, 14 July 1977.

6. TOP 2-2-808, Field Shock and Vibration Tests of Vehicles, 1 October 1981.

7. TOP 10-2-214, Large Cargo Containers, 20 September 1974.

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APPENDIX B. TEST SCHEDULE

1. Schedule of Events

Test plan submission	November 1992
Coordination completed	November 1992
Test planning completed	November 1992
Test item received	November 1992
Testing initiated	November 1992
Testing complete	January 1993
Draft report to TECOM	February 1993
Draft report approved	February 1993
Report published	March 1993

2. Detailed Test Schedule

Name of Subtest	Time Increment, months					
	X+1	X+2	X+3	X+4	X+5	X+6
Initial Inspection	XX					
Road Shock and Vibration		XX				
Transit Drop			XX			
Rail Impact				XX		

X - Test item delivery date

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APPENDIX C. DISTRIBUTION LIST

Addressee	Plan	TIRs	Report
Commander U.S. Army Test and Evaluation Command ATTN: AMSTE-TA-S Aberdeen Proving Ground, MD 21005-5055	2	1	2
Project Manager Combat Terrain Information Systems ATTN: CETEC-TL-RD Fort Belvoir, VA 22060-5546	5	1	5
Commander U.S. Army Combat Systems Test Activity ATTN: STECS-AE-SM	4	1	4
STECS-EN-EV	1		
STECS-SO	1		1
STECS-AD-A Aberdeen Proving Ground, MD 21005-5059	1		1
Administrator Defense Technical Information Center ATTN: FDAC Cameron Station Alexandria, VA 22314	1		1

Secondary distribution is controlled by Project Manager, Combat Terrain Information Systems ATTN: CETEC-TL-RD.

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